

Town of Needham, MA

# The Massachusetts Stretch Energy Code

An Explanation and Analysis

Matthew Hammer  
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## ***Stretch Code Key Terms***

**ASHRAE:** American Society of Heating, Refrigerating, and Air Conditioning Engineers.

**ASHRAE 90.1-2007:** Energy standard developed by ASHRAE providing minimum requirements for the energy-efficient design of buildings—including new buildings and their systems, new portions of buildings and their systems, and new systems and equipment in existing buildings. Applicable to all buildings except low-rise residential buildings.<sup>1</sup>

**BBRS:** Massachusetts Board of Building Regulations and Standards, a division of the Massachusetts Department of Public Safety, and administrator of the state’s building code.

**Energy Modeling:** Energy modeling is the use of computer software to simulate the energy use of a building, and thus its efficiency, over time. Energy modeling takes into account factors such as a building’s air sealing, insulation levels, lighting design, ventilation, and the efficiency of the cooling and heating systems.

**Energy Star Homes Program:** A program developed by the U.S. Environmental Protection Agency to identify homes (single or multi-family homes, three stories or less) that meet certain established guidelines for energy efficiency. Energy Star qualified homes are typically 20%-30% more energy efficient than standard, newly built homes, and are required to be at least 15% more efficient than homes built to the 2004 International Residential Code standard. To qualify as an Energy Star home, the building must pass third party inspection by a licensed HERS rater. The new Massachusetts Stretch Code’s standards meet or exceed the minimum energy efficiency a home requires for Energy Star designation, thus qualifying all homes built under the Stretch Code for builder incentives and rebates afforded to Energy Star Homes.<sup>2</sup>

**Energy Star Homes Builder Option Package:** A set of prescriptive standards established by the U.S. Environmental Protection Agency that builders can use to demonstrate compliance to the Energy Star Homes Program.<sup>3</sup>

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<sup>1</sup> American Society of Heating, Refrigerating, and Air Conditioning Engineers, 2008

<sup>2</sup> United States Environmental Protection Agency, 2009

<sup>3</sup> Residential Energy Services Network, 2009

**Green Communities Act:** Passed in July 2008, the Massachusetts Green Communities Act is a major energy reform act aimed as an investment in energy efficiency programs. Among other items, the act includes provisions that require the state to reduce greenhouse gas emissions, provide funding for a variety of energy efficiency initiatives, integrate the International Energy Conservation Code into the state building code, and create the Green Communities Program.

**Green Communities Program:** Created by the Green Communities Act of 2008, this program aims to make Massachusetts' cities and towns more environmentally sustainable by reducing energy costs and incubating green energy technology and practices. To receive official Green Communities designation, cities and towns must: 1) adopt local zoning bylaw or ordinance that allows "as-of-right" siting of renewable energy projects—siting that does not unreasonably regulate these uses, 2) adopt an expedited permitting process related to the as-of-right facilities, 3) establish a municipal energy use baseline and establish a program designed to reduce baseline use by 20 percent within five years, 4) purchase only fuel-efficient vehicles for municipal use, whenever such vehicles are commercially available and practicable, and 5) require all new residential construction over 3,000 square feet and all new commercial and industrial real estate construction to reduce lifecycle energy costs.<sup>4</sup>

**HERS Index Score:** "The HERS Index is a scoring system established by the Residential Energy Services Network (RESNET) in which a home built to the specifications of the HERS Reference Home (based on the 2006 International Energy Conservation Code) scores a HERS Index of 100, while a net zero energy home scores a HERS Index of 0. The lower a home's HERS Index, the more energy efficient it is in comparison to the HERS Reference Home. Each 1-point decrease in the HERS Index corresponds to a 1% reduction in energy consumption compared to the HERS Reference Home. Thus a home with a HERS Index of 85 is 15% more energy efficient than the HERS Reference Home and a home with a HERS Index of 80 is 20% more energy efficient."<sup>5</sup> The lower the score, the more efficient it is. Older, unimproved homes typically have ratings well over 100. The score is determined by energy modeling of a building's structure and systems by a certified HERS rater (see 'HERS Rating' entry).

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<sup>4</sup> Executive Office of Energy and Environmental Affairs, 2009

<sup>5</sup> U.S. Environmental Protection Agency et al, 2009

**HERS Rating:** “A home energy rating involves an analysis of a home’s construction plans and onsite inspections. Based on the home’s plans, the Home Energy Rater uses an energy efficiency software package to perform an energy analysis of the home’s design. This analysis yields a projected, pre-construction HERS Index [...] The rater then conducts onsite inspections, typically including a blower door test (to test the leakiness of the house) and a duct test (to test the leakiness of the ducts). Results of these tests, along with inputs derived from the plan review, are used to generate the HERS Index score for the home.”<sup>6</sup>

**IECC-2009:** International Energy Conservation Code, 2009 Edition. Beginning in 2010, this will be the new base energy code for the Commonwealth of Massachusetts. Developed and published by the International Codes Council, the IECC-2009 “establishes minimum regulations for energy efficient buildings using prescriptive and performance-related provisions [...] This code is founded on principals intended to establish provisions consistent with the scope of an energy conservation code that adequately conserves energy; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction.” The code is climate sensitive and a new, up-to-date edition is promulgated every three years.<sup>7</sup>

**LEED:** Leadership in Energy and Environmental Design. A rating system developed by the United States Green Building Council that provides a checklist of standards to measure the environmental sustainability of all facets of a building’s construction. The LEED rating system criteria includes energy efficiency, water and storm-water management, and landscaping/site design. It is more comprehensive in nature than a state’s building or energy code.

**Performance Based:** The energy code approach that requires an expected level of energy use based on modeling.

**Prescriptive:** The code option in which particular measures are required, such as specific air sealing characteristics and insulation levels.

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<sup>6</sup> U.S. Environmental Protection Agency et al, 2009

<sup>7</sup> International Code Council, 2009

**REScheck:** Software and materials developed by the U.S. Department of Energy to assist builders with meeting various code requirements, including the IECC. REScheck is an accepted tool for meeting the new Massachusetts base energy code, but not the Stretch Code. REScheck offers two different paths to meet code requirements:

Prescriptive Approach: Following a predetermined list of minimum standards for each component of the building.

Trade-Off approach: Trading enhanced energy efficiency in one component (e.g. windows) against decreased energy efficiency in another component (e.g. wall insulation).<sup>8</sup>

**Stretch Code:** Also known as the “Stretch Energy Code” or “Massachusetts Building Code (780 CMR) Appendix 120 AA,” the Stretch Code is an optional building energy code that can be voluntarily adopted by cities and towns in place of the base building code, IECC-2009. The Stretch Code is an amended version of this base code, with “approximately 20% greater building efficiency requirements, and a move towards 3<sup>rd</sup> party testing and rating of building energy performance.”<sup>9</sup>

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<sup>8</sup> United States Department of Energy, 2009

<sup>9</sup> Executive Office of Public Safety and Security, 2009

## ***The Massachusetts Stretch Energy Code***

The Green Communities Act of 2008 enacted a number of energy efficiency measures for the Commonwealth of Massachusetts, one of which was mandating that the state adopt the latest version of the International Energy Efficiency Code (IECC-2009) as the new base building energy code beginning in 2010. The adoption of the IECC will yield substantial improvements in the energy efficiency of residential and commercial properties around the state, for both new construction as well as renovated structures. The Green Communities Act not only requires the adoption of IECC-2009, but also the adoption of each new version of this code, of which an updated edition is published every three years. This new code will help reduce greenhouse gas emissions statewide in accordance with the Global Warming Solutions Act of 2008 which mandated a 10%-25% reduction from 1990 levels of these emissions by 2020, and an 80% reduction by the year 2050. It is estimated that greater than 40% of greenhouse gas emissions in the United States can be attributed to building energy use.<sup>10</sup>

While the IECC-2009 is indeed an improvement in energy efficiency over the current state building code (780 CMR), there has been a substantial movement for an even stronger set of building efficiency standards or at least the possibility of offering a stricter building code at the local level. As local municipalities are not permitted to diverge from the state building code, that route was not an option. Additionally, there was a significant amount of concern raised by the development industry concerning employing numerous building codes in different municipalities throughout the state. In response, the Massachusetts Board of Building Regulations and Standards (BBRS) developed the Stretch Energy Code, an optional, more energy efficient version of the IECC-2009 that can be adopted at the local level as an appendix to the new base code. This single alternative code was the compromise between demands for stricter standards and a concern over the potential for multiple and inconsistent building energy standards around the state. The finalized Stretch Code has received wide-spread support, including an endorsement by the Massachusetts Municipal Association, which said “We believe that the standards called for in Appendix 120.AA are attainable using current construction technology, and will be cost effective. We support stricter codes as a way to realign the cost/benefit of energy efficient construction. To this point, a builder with no stake in future cost savings has had absolutely no incentive to design and construct in a way which minimizes future operational expenses.”<sup>11</sup> According to Vernon Woodworth of the Boston Society of Architects Codes Committee, the “‘Stretch’ Energy Code anticipates future energy requirements while encouraging localized and incremental transformation of the construction industry.”<sup>12</sup>

### ***How does the Stretch Code differ from the new base code (IECC-2009)?***

The Stretch Energy Code is more stringent than the base code with the majority of enhancements coming in the form of a higher quality building envelope, a little more insulation all around including basement, wall and floor insulation, more efficient heating and cooling systems, and

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<sup>10</sup> New Buildings Institute, 2009

<sup>11</sup> Breslow, 2009

<sup>12</sup> Woodworth, 2009

more efficient lighting. All of the requirements in the Stretch Code can be met by utilizing widely available and affordable materials. The Code also offers provisions for third party testing (to ensure quality performance) and a rating system for building energy performance.

For commercial buildings, the enhancements translate into roughly 20% greater energy efficiency. For residential buildings, the Stretch Code translates into roughly 30-35% greater energy efficiency than the existing base code, and a smaller improvement over the new base code, IECC-2009 (given that this code is already an improvement over the existing base). The Stretch Code for residential buildings is roughly the equivalent to meeting the Massachusetts requirements of the National Energy Star for Homes (Tier 2) standard for new buildings and the Energy Star base standard for building renovations, thus qualifying buildings built to Stretch Code standards for Energy Star-based financial incentives.

The standards and rating systems utilized by the Stretch Code are the same as those already in use and recognized by the federal government as well as electric and gas utilities. Additionally, “it is finely tuned, with modeling based on the Massachusetts climate, and specific requirements for different types and sizes of buildings and for new construction versus major renovations.”<sup>13</sup> For example, the Stretch Code provides considerably looser standards for building renovations versus new construction, due to the fact that sealing an older home to the same degree as a newly built one would not only be more expensive but also quite challenging. According to the New Buildings Institute, “Because affecting a building’s energy use is more expensive *after* construction, the most cost effective opportunities occur at the time of construction or during a major remodel or replacement of major systems. It is at this time that building energy codes apply and that the greatest energy savings can be captured most economically.”<sup>14</sup>

See attached table summarizing Code specifics.

### ***Characteristics of the Stretch Code: Residential<sup>15</sup>***

For residential buildings, the Appendix mandates that homes larger than 3,000 square feet achieve a Home Energy Rating System (HERS) rating of 65 or less. HERS is designed so that houses built to the standard building code achieve a rating of about 100 (the base code in Massachusetts yields a bit below 100), so a 65 means that the home is about 35% more efficient than a similarly sized home built to base code levels. Homes smaller than 3,000 square feet must achieve a score of 70 or better.

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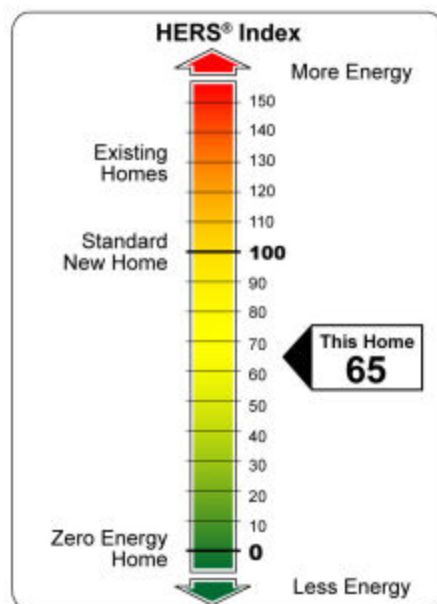
<sup>13</sup> Breslow, 2009

<sup>14</sup> New Buildings Institute, 2009

<sup>15</sup> Ibid

For additions and major renovations, the requirement is HERS 80 for buildings (or individual units in multi-unit buildings) bigger than 2,000 square feet, and 85 for those less than 2,000 square feet. But for such buildings there is also an option to skip the HERS rating and instead follow a set of “prescriptive” measures, such as air sealing methods, insulation levels, Energy Star windows, and high-efficiency heating systems. The requirements would only be applied to those aspects of the building that are being changed. For example there is no mandate that windows be replaced, but if they are Energy Star windows must be used.

HERS is already the rating method used by the Massachusetts Energy Star Homes program, through which the electric utilities provide significant financial incentives to homebuilders. Even without the Stretch Code, a substantial percentage of the Energy Star homes being built in the state today are attaining a score of 65 or better (note: of about 1,000 Energy Star homes that were built in Massachusetts in 2008, 225 had a HERS rating of 60 or below, surpassing the Stretch Code level of requirement<sup>16</sup>).



Source: [www.natresnet.org](http://www.natresnet.org)

<sup>16</sup> Executive Office of Environmental Affairs, 2009

### ***Costing the Stretch Code: Residential***

Before the Stretch Code was adopted by the BBRS, detailed modeling was conducted to ensure that the Appendix would yield cost savings to homeowners. For a typical 2,672 square foot, three-bedroom home, meeting a HERS rating of 60 (a bit better than the Stretch Code requires), consultants estimated that a homebuyer would see an immediate savings of about \$830 a year. This is based on energy cost savings of \$1,360, more than offsetting the extra \$530 a year in payments on a 30-year mortgage at 5% interest that would result from \$8,100 in higher construction costs. See breakdown below.

Home Improvement Costs	\$8,103
Mortgage Interest Rate	5%
Loan Term	30 years
Annual Incremental Mortgage Payment	\$527
Annual Energy Costs	\$3,103
Annual Energy Savings from Baseline	\$1,364
<b>Annual Cash Flow Gain</b>	<b>\$837</b>

Note: This model does not include the cost of a HERS rater or the savings from utility rebates and federal tax credits

To put this simply, if I am interested in building (or purchasing a newly built) 2,672 sq. ft. home which will meet the stretch code requirement of a HERS rating of 60 or better, it will require roughly \$8,103 more in up front construction cost than a typical home of comparable size (not meeting HERS 60 or better). This cost added into a 30 year mortgage with a 5% interest rate will increase my mortgage payment by \$527 per year for the life of the mortgage, which seems like a lot. However, we must take into consideration the potential energy cost savings over the life of this mortgage repayment (and beyond!). Typical energy costs for the average house of this size not meeting stretch code requirements are roughly \$3,103 per year. Because of the energy efficiency measures that were purchased with my added up-front costs, I will be saving roughly \$1,364 per year in energy bills. If I subtract the aforementioned annual mortgage increase of \$527 from this energy saving, I end up with a net *gain* in my cash flow of \$837 per year.

The measures needed to reach HERS 65 are all common building techniques—high levels of insulation in the roof and walls, insulated basement walls and floor, quality air sealing, high-efficiency heating and cooling systems, and 75% fluorescent lighting. The cost estimation and modeling of an urban building renovation meeting a HERS rating of 80 or 85 shows similar net cost savings.<sup>17</sup>

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<sup>17</sup> Faesy, Hollingsworth, 2009

	Existing Home: Baseline	Stretch Code: Upgrade 1	Stretch Code: Upgrade 2
<b>HERS Index Modeled in REM/Rate</b>	143	85	80
<b>Improvement Costs</b>		\$14,847	\$29,395
<b>Mortgage Interest Rate</b>		6%	6%
<b>Loan Term</b>		30 years	30 years
<b>Annual Incremental Mortgage Payment</b>		\$1,079	\$2,135
<b>Annual Energy Costs</b>	\$9,719	\$6,992	\$6,682
<b>Annual Energy Savings from Baseline</b>		\$2,727	\$3,037
<b>Annual Cash Flow</b>		<b>\$1,648</b>	<b>\$902</b>

Note 1: For a full analysis including list of specific improvements, see appendix.

Note 2: Model does not include any utility or government incentives that would likely be available for such a renovation.

To put this in narrative, assume I own an older two family building in a relatively urban area. Because it is an older building, it is poorly insulated and thus has yearly energy costs of \$9,719. I am interested in making upgrades to the building in order to modernize it with the hopes of one day selling it. Because of the new stretch code, my renovations will be required to considerably improve the building's envelope in order to meet a HERS rating of 85 (it is currently at a HERS rating of roughly 143). Meeting these requirements will require up-front improvement costs of \$14,847. Tacking that onto my mortgage at an annual rate of 6% will increase my 30 year mortgage by \$1,079 per year, which seems quite expensive. However, considering the extent to which I am improving my building's efficiency, my yearly energy savings must be taken into consideration. As aforementioned, my pre-renovation energy costs are \$9,719 annually. After my renovations, my annual energy costs will decrease to \$6,992 per year. That is \$2,727 of savings annually. When I subtract the added mortgage cost of \$1,079 per year, I am left with a net cash gain of \$1,648 per year.

### ***Characteristics of the Stretch Code: Commercial<sup>18</sup>***

For commercial buildings, the Stretch Code sets a target of 20% less energy use than the ASHRAE 90.1-2007 code standard. Buildings larger than 100,000 square feet must be designed to meet this standard by means of energy modeling specific to that building. This would also apply to residential buildings that are more than three stories and more than 100,000 square feet. Energy modeling is the use of computer software to simulate the energy use of a building, and thus its efficiency, over time. Energy modeling takes into account factors such as a building's air sealing, insulation levels, lighting design, ventilation, and efficiency of the cooling and heating systems. Such modeling is the industry standard and is also used in the LEED green building program. Achieving 20% below ASHRAE 90.1-2007 qualifies for 5 out of 19 LEED energy points, so a building developer may adopt additional energy efficiency measures beyond what the Stretch Code requires in order to earn LEED green building certification.

Buildings between 5,000 and 100,000 square feet would have the option of either achieving the 20% reduction through modeling, or following a set of prescriptive requirements based on the Core Performance Guide of the New Buildings Institute. "Core Performance" is the standard now used by the electric utilities in Massachusetts as the basis for providing energy saving incentives to commercial builders.

Commercial buildings smaller than 5,000 square feet; specialty buildings such as supermarkets, laboratories, and warehouses less than 40,000 square feet; and commercial alterations and renovations are all exempt from the Stretch Code requirements. This is largely due to the complexity and broad variety of existing commercial buildings.

### ***Costing the Stretch Code: Commercial<sup>19</sup>***

Extensive energy modeling including both regional and Boston-specific climate runs has shown that the measures required by Core Performance save building owners or tenants more in energy bills than the additional construction costs. For example, one case study highlighted by National Grid (NGRID) is the 60,000 square foot Home Loan Bank building in Warwick, Rhode Island. NGRID projects that annual energy savings will be about \$29,500, compared to an increased construction cost of \$91,000, for a simple payback of three years. But NGRID will pay the owners \$63,000 in incentives, cutting the net cost to \$28,000, yielding a one-year payback. The specific improvements to the building include higher-efficiency lighting, advanced lighting controls, high efficiency heating, cooling and ventilation systems, and high performance windows. See attached case studies.

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<sup>18</sup> Breslow, 2009

<sup>19</sup> Ibid

Massachusetts is generally one of the highest states in average retail price of electricity for the residential, commercial, and industrial sectors. According to data published by the Energy Information Administration, in June, 2009, the state had the fourth highest average retail price of electricity for the residential sector, and was second only to Hawaii in highest rates for the commercial sector. (<http://eia.doe.gov/>)

### ***Adopting the Stretch Code***

In order to adopt the Stretch Code, the Code must be considered at a public hearing, subject to a municipality's existing public notice provisions. Once the appropriate public hearing is held, the town's governing body—in Towns the board of selectmen—can then vote to adopt the Stretch Code. The State will provide local building officials with free training concerning Stretch Code enforcement.

BBRS regulations require a six month concurrency period between adoption and implementation, during which both the base code and Stretch Code will be in effect; Property owners may voluntarily choose to follow the Stretch Code during the concurrency period, but building inspectors must allow compliance through either the base code or the Stretch Code during this period. Additionally, the BBRS is limiting adoption dates to two per year (January 1 and July 1) to avoid potential confusion in the development community. For example, if a town votes to adopt the Stretch Code in February, their adoption will not actually occur until July 1. Beginning July 1, both the base and Stretch Codes will be in effect for six months. Following this concurrency period, the Stretch Code will be the sole energy code January 1. The dates are interchangeable (concurrency can began January 1 and sole Stretch Code enforcement July 1).

According to estimates provided by representatives from the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA), about 120 municipalities have committed to exploring adopting the Stretch Code through the Green Communities Program. The EOEEA had anticipated that roughly 5-6 municipalities would comprise the "first wave" of Stretch Code adoptions, meaning completing the necessary steps so the Code would have gone into effect January 1, 2010. As of mid-January, Newton, Cambridge, and reportedly three towns in western Massachusetts (Lenox, East Longmeadow, and one other the name of which could not be confirmed) have adopted the Stretch Code. According to the EOEEA, Boston, Brookline, Lexington, Carlisle, Acton, Arlington, and Bedford are not far behind and are seriously considering adoption.

## ***Financial Incentives/Rebates Available***

Note: Federal and State incentives for energy efficient buildings vary in amounts from project to project based on levels of efficiency, types of construction, enhancements made, etc. The following are samples of potential financial benefits, in addition to the savings in utility costs, associated with the energy efficiency enhancements of the Stretch Code. For a more expansive list of green building incentives, visit: [www.dsireusa.org](http://www.dsireusa.org) ; [www.energystar.gov](http://www.energystar.gov) ; [www.energystarhomes.com](http://www.energystarhomes.com) ; [www.nstar.com](http://www.nstar.com) ; or [www.mass.gov/doer](http://www.mass.gov/doer).

### Benefits for towns

- The Stretch Code satisfies part of the requirements for the Green Communities Program. If a town meets the five requirements established for the program (see key terms section), it will be qualified for part of the \$10 million in grant money allocated through the state. Technical assistance will also be provided free of charge to qualifying municipalities.
- The State is offering free Stretch Code training to local building officials.
- A stronger energy code requiring buildings to be more energy efficient reduces the amount of electricity, natural gas, and fuel oil consumed by a community saving current and future residents a considerable amount of money heating, cooling, and lighting their homes and putting less stress on associated infrastructure.
- More energy efficient buildings will help reduce the cost of conducting business in the community.
- Stricter energy code requirements will also increase competitiveness in the growing green building marketplace, contributing to lower costs overall for green design and construction.

### Benefits for Builders/Property Owners

- Most homes built according to Stretch Code requirements will qualify for the Massachusetts Energy Star Homes Program at the Tier II level, qualifying them for a \$1,250 rebate.
- Stretch Code requirements also qualify new homes for the Federal Energy Star Homes program. Qualifying homes receive up to \$2,000 in tax credits per residential unit built to this standard.
- For property owners renovating/rehabbing their homes, or looking to upgrade their systems, the Federal Residential Energy Efficiency tax credit allows the property owners to receive as a

tax credit 30% of the cost of an upgrade in the building's envelope (insulation, doors, windows, and roofing) and/or an upgrade of heating, cooling, or water heating equipment, up to \$1,500.

- NSTAR offers several incentive programs including the Business and Small Business Solutions Programs, Construction Solutions Program, Residential Energy Efficiency Programs, and the NSTAR Gas Commercial Energy Efficiency Programs, all which assist builders, developers, and property owners to defray costs associated with increasing building energy efficiency.

## ***Opposition***

In addition to widespread support for the Stretch Code from organizations such as the Massachusetts Municipal Association and the Boston Society of Architects, there has been some opposition as well, particularly from NAIOP, the commercial real estate development association of Massachusetts, and the Massachusetts Home Builders Association (HBAM). The following is a summary of the primary complaints concerning the Stretch Energy Code.

First, the creation of the Stretch Code has indeed created a lack of uniformity in the State's building code. While the Stretch Code is technically the same code as the base (because it is merely an appendix to that code), the fact remains that with the adoption of the Stretch Code in different municipalities, there will now be two different standards whereas for the past thirty-seven years there has only been one unified code throughout the Commonwealth. HBAM fears this undoing of the unified building code will "serve as a precedent for the BBRS to adopt other 'local option' provisions in the future, depending upon the lobbying strength of any particular manufacturer, business or interest group," further contributing to a "fragmented building regulatory system"<sup>20</sup> that will create difficulties and confusion in code enforcement.

Second, and perhaps preeminently, is the issue of cost. The enhancements to building energy efficiency that are required in the Stretch Code will indeed increase the up-front costs to both new and renovated buildings. While NAIOP and HBAM have estimated that the code will add up to \$10,000 to the up-front cost of a newly constructed house, modeling performed by the BBRS indicates the actual amount to be less than that. With government incentives and utility rebates factored in, coupled with the energy savings created by a more efficient building, the end cash flow is a net positive. Nonetheless, considering the up-front costs are just that, up-front, it increases the strain on a builder's project budget. NAIOP and HBAM insist this is not the correct time to add additional strain to the economy as well as the housing and development markets. According to Tamara Smalls of NAIOP Massachusetts, "There is no question that the Stretch Code will increase the cost of construction. At a time when vacancies in commercial buildings are rising and rents are dropping, such increases are not feasible." In short, in a weak economy, it will be harder for developers to recover extra costs.

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<sup>20</sup> Fierro, 2009

Third, the adoption of IECC-2009 as the new base energy code will increase building efficiency in the commonwealth, and thus the necessity of an even stricter code on top of that is brought into question. Further complicating this matter is the provision in the Green Communities Act that requires the Commonwealth to adopt each new IECC code that is promulgated by the International Codes Council. As each new edition of the IECC contains more energy efficiency enhancements than the previous, there seems to be a potential that the base code will simply catch up to the Stretch Code's efficiency standards within the next several years. Yes, the Stretch Code will speed up the state's transition into a greener economy and built environment, but is the strain of the transition worth the large step forward?

Both NAIOP and HBAM support a market based approach to green buildings. According to Tamara Smalls, "NAIOP supports the use of energy efficient practices. However, businesses are already moving in this direction without mandates. Many new developments are incorporating energy conservation and green building standards, with many on track to obtain LEED certification. We believe it should be up to the developer, not the municipality, to determine what is appropriate for their individual projects [...] We believe the proposed code will drive up the costs of doing business, making the state [and municipalities with the Stretch Code] uncompetitive for many existing and new businesses."

**Summary of “Stretch” Appendix to Massachusetts Energy Code, Adopted by BBRs May 2009**

<b>Building Category</b>	<b>Definition</b>	<b>Requirements based on energy performance (can do prescriptive instead where shown)</b>	<b>Alternative “prescriptive” requirement—specific efficiency measures</b>	<b>Source, comments</b>	<b>Benefit—cost modeling results</b>
<b>New Residential</b>	Single-family, multi-family of 3 stories or less	HERS index 65 above 3,000 sq/ft, 70 below 3,000 sq/ft, certified by HERS rater; follow Energy Star thermal bypass checklist	None	HERS rating=energy use as % of use under IECC code. Current Mass. Code= about HERS 99; soon to be adopted IECC-2009= about HERS 92	Sample 3 bedroom home, estimate \$837/year savings (\$8,103 extra construction cost = \$527/year higher mortgage, but save \$1,364/year energy costs)
<b>Residential Additions</b>	Expansions of existing living space	HERS 80 over 2,000 sq/ft, HERS 85 under 2,000 sq/ft; certified by HERS rater (alternative is the prescriptive option)	Alternative path to a HERS—rating same as residential rehab below		3-bed home, estimate \$40/year savings (\$10,168 extra construction cost=\$661/year, but energy costs=\$701/year lower)
<b>Major Residential Rehab/Alterations</b>	Major alterations as in existing code—excludes storm windows, re-roofing, doors, etc.	HERS 80 over 2,000 sq/ft, HERS 85 under 2,000 sq/ft; certified by HERS rater (alternative is the prescriptive option)	Prescriptive option of Energy Star Homes Program; insulation equal to IECC-2009 for climate zone 5.	Quality air-sealing and insulation, Energy Star windows.	
<b>Large Commercial and Large Residential Multi-family</b>	Commercial above 100,000 sq/ft; residential 4 stories or more and above 100,000 sq/ft	Energy use 20% below ASHRAE 90.1 2007, determined by modeling	None	DOE, National Grid modeling show energy savings greater than 20%	
<b>Medium Commercial and Residential Multi-family</b>	Commercial 5,000 to 100,000 sq/ft, residential 4 stories or more and below 100,000 sq/ft	Energy use 20% below ASHRAE 90.1 2007, determined by modeling	IECC-2009 with NBI Core performance: improved air sealing, insulation, lighting, etc.	Prescriptive option is based on the New Buildings Institute program; used by utilities now for incentive programs	National Grid, NStar case studies. Example—60,000 sq/ft office building: \$91,000 extra cost, \$29,500 annual energy savings; and \$63,100 N-Grid rebate
<b>Small Commercial</b>	Below 5,000 sq/ft	Exempt	Exempt		
<b>Specialty Commercial</b>	Supermarkets, labs, warehouses below 40,000 sq/ft	Exempt	Exempt	Other specialty buildings can apply for waiver	
<b>Commercial Alterations and Renovations</b>		Exempt	Exempt		

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# Fidelity Bank

## Corporate Office and Branch Case Study

Leominster, MA

### Advanced Building Features

- High Efficiency T-5 Pendant Lighting
- Lighting Control Efficiency
- Reduced Lighting Power Density
- Efficient Site Lighting
- Additional Wall Insulation
- High Performance Glazing
- Efficient VAV RTU's, with ECM Motors
- Demand Control Ventilation
- Part Load HVAC Efficiency Enhancements

### Funded Utility Services Support

- Early Life Cycle Cost Analysis
- Integrated Design Team Approach
- Commissioning



### Project Description

The 47,000 SF Fidelity Bank Corporate Office and Branch was constructed as a design-build project in Leominster, MA. The four story building will provide office space plus a ground floor branch bank office. This project is acclaimed for its highly successful implementation of the national Advanced Buildings program. The project demonstrates the validity of the Advanced Buildings program assertions. The guideline cost effectively delivered even more than the expected 20% to 30% reduction in annual energy costs compared to a code based design.

### Envelope Improvements

- Walls: Added 3-1/2" batt insulation to planned 2" rigid.
- Glazing:
  - Upgrade U value from 0.42 to 0.31
  - Upgrade SHGC from 0.50 to 0.30
- Projected envelope savings: \$1,500

### Project Team

Owner:

**Fidelity Bank**

Project Management:

**Habitat Advisory Group**

Architect:

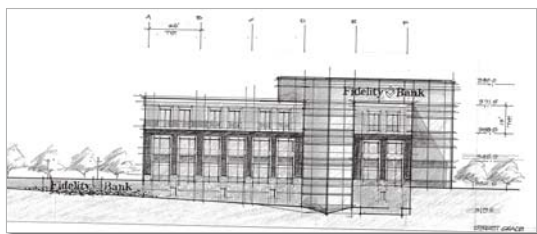
**Maugel Architects**

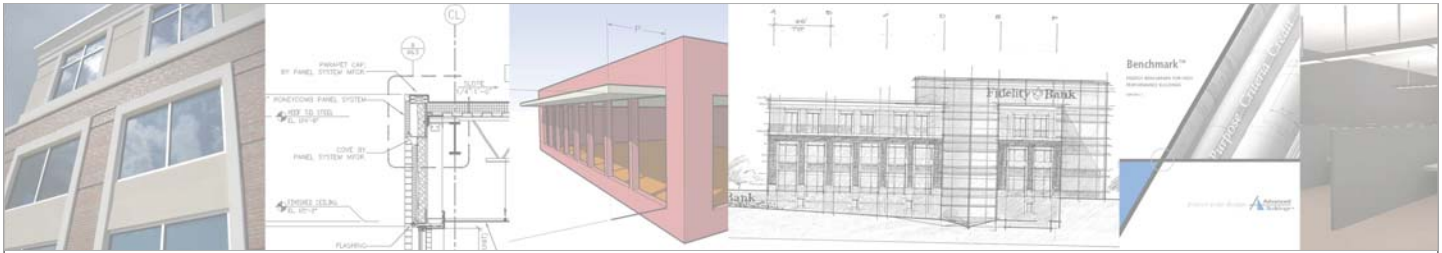
General Contractor:

**Construction Dynamics**

Energy Efficiency Incentives and Support:

**National Grid and Keyspan Energy Delivery**





## High Performance Building Design Uses 31% Less Energy

### Savings Projection

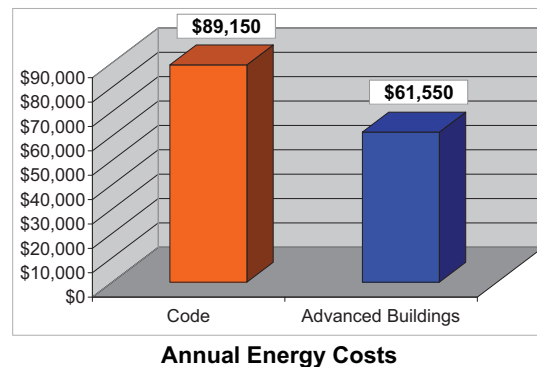
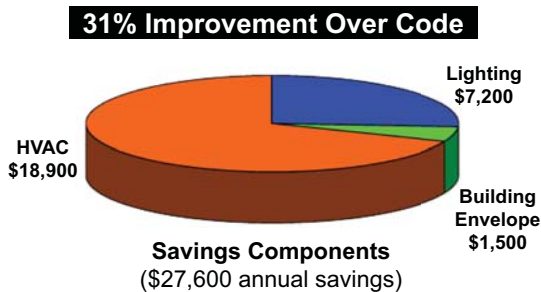
Annual Energy Savings:	\$ 27,600
Additional Cost for Upgrades:	\$100,622
Utility Incentives:	- \$ 66,587
Net Owner Costs:	\$ 34,035

**Payback with Incentives:**

**1.2 years ROI: 83%**

Payback without Incentives:

3.7 years ROI: 27%



### Lighting Savings Summary

The lighting layout consisted mainly of T-5 pendants in open office areas, and the latest generation of recessed T-5 fixtures in the remaining areas.

Projected Lighting Savings: \$7,200



	Mass Energy Code	Advanced Buildings Criteria	Final Design	% Reduction
Lighting Power Density	1.34 w/SF	0.96 w/SF	0.86 w/SF	36%

**Improved lighting quality while using less energy!**

### HVAC Savings Summary

***HVAC moves that deliver!***

Advanced Buildings emphasizes an integrated approach to the HVAC Design with particular focus on efficiency under part load conditions. Savings are credited to Advanced Buildings' focus on the specifics of the application instead of just the full load equipment efficiency.

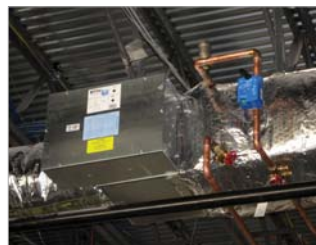
Advanced Buildings additional investments:

- 10.2 EER HVAC Units
- Demand Controlled Ventilations (CO2 Controls)
- ECM Fan Box Motors
- Dedicated Data Room Cooling Unit

Projected HVAC Savings: \$18,900

**Payback Before Incentives: 1.8 Years**

Efficient HVAC Cost: \$ 34,100



## Home Loan Investment Bank Case Study Warwick, Rhode Island

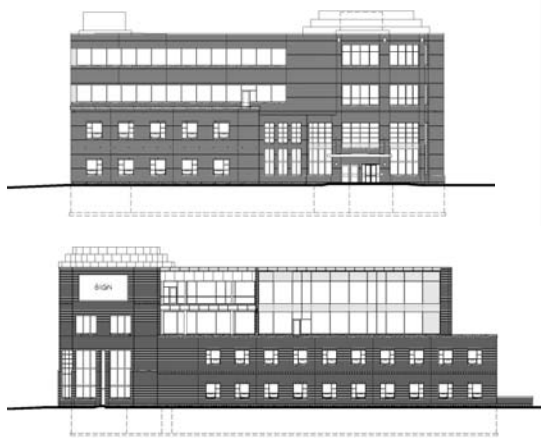
# High Performance Building Design

### Advanced Building Features

- High Efficient Lighting Upgrade
- Lighting Controls
- High Performance Rooftop Units
- High Performance Windows
- HVAC Controls Upgrade
- Cool Roof

### Project Description

The new four-story Home Loan Investment Bank office building under construction in Warwick, Rhode Island is a 60,000 SF building housing offices with a small tenant space on the first floor. By embracing the Advanced Buildings Protocol, the design team reduced the facilities projected annual energy use by 21%+ compared to Rhode Island State Code, while providing high quality lighting and mechanical systems. The payback for these upgrades was less than one year after utility incentives provided by National Grid. The dedicated owner and design team focused on applying an integrated approach, contributing to streamline the decision process and integrate energy efficiency measures up front.



### Building Envelope

Envelope improvements incorporated into the building design are a cool roof, high performance exterior glazing systems and additional wall insulation. The windows have improved Low E-coating with a U-value of 0.44 (assembly unit), and a highly efficient shading coefficient of 0.28 to reduce air conditioning loads. These products were readily available and added less than \$40,680 to the project cost, with a return of over \$10,155 a year in annual savings.

### Project Team

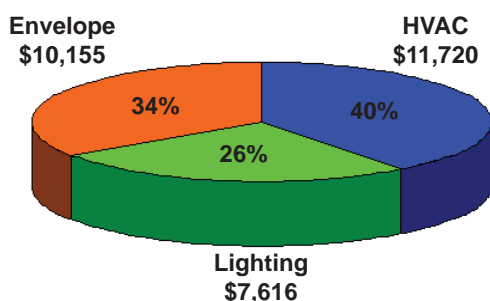
Owner: **Home Loan Investment Bank**  
 Architect: **Saccocio & Associates**  
 Engineer: **Cataudella Engineering**  
 Energy Efficiency Incentives and Support: **National Grid**



## High Performance Building Design Uses 21%+ Less Energy

### Savings Projections

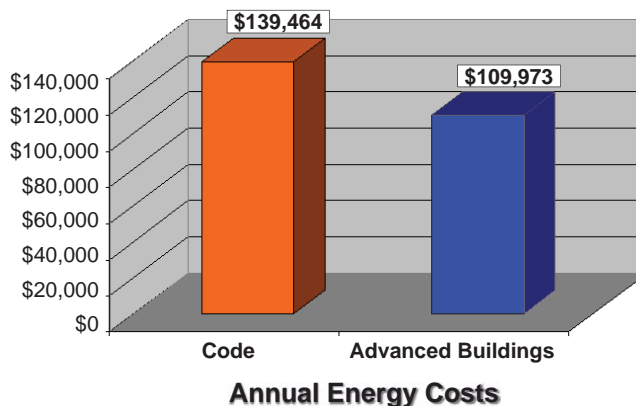
Annual Energy Savings:	\$29,491
Additional Cost for Upgrades:	\$91,025
Utility Incentives:	\$63,143
Net Owner Cost:	\$27,882



**Savings Components**  
(\$29,491 Annual Savings)

Payback with Incentives: 11 month ROI 105%

### 21% Improvement Over RI Code



### Lighting Savings Summary

A cost effective, energy-efficient, high quality lighting system is provided.

T-5 pendant fixtures are used in open office areas which benefits from their broad distribution. The latest T-5 recessed style fixtures with tuned lamp/ballasts combinations are used in private offices to limit the total lighting wattage. Beyond efficiency, these fixtures are far more attractive and offer better quality lighting than parabolics. The use of efficient lighting controls such as occupancy and daylight sensors also contribute to the \$7,616 annual lighting savings.



Source: Attune

### Mechanical Systems

High-efficient condensing boilers for the space heating and Variable Speed Drivers on the VAV fans are the primary sources of the \$11,720 HVAC savings. High efficiency roof top air conditioners with premium enthalpy economizer controls also contribute. Condensing boilers exceed the minimum efficiency requirements for Advanced Buildings, boosting energy savings by over \$3,000 while earning \$9,000 in direct incentives.



Source: Finelite

\*\*\*Note: The preliminary estimated figures shown above are based on information available at this time and pending final review and approval by National Grid.



## **Guidelines for Qualifying as a Green Community**

### **SUMMARY OF REQUIREMENTS TO QUALIFY AS A GREEN COMMUNITY**

As outlined in MGL c. 25A §10(c), a municipality or other local government body must do all of the following:

**NOTE:** One or more municipalities may together submit an application to qualify as a regional Green Community. Each municipality in a regional application must meet each of the requirements with one exception: the 20% reduction from the energy baseline can be applied in the aggregate across all of the municipalities. When grant awards are made to those communities who have qualified as a Green Community, special consideration will be given to regional applications.

1. Provide for the as-of-right siting of renewable or alternative energy generating facilities, renewable or alternative energy research and development (R&D) facilities, or renewable or alternative energy manufacturing facilities in designated locations.
  - “As-of-Right Siting” is defined as siting that provides for the allowed use of, and does not unreasonably regulate, or require a special permit.
  - An applicant can meet this requirement by providing as-of-right siting for one of the three types of facilities described.
  - If a community has as-of-right siting in place for R&D and/or manufacturing facilities in general, this can meet this requirement, but the community must demonstrate that the zoning by-law applies to renewable and alternative energy R&D or manufacturing.
  - Communities can select the specific locations for the as-of-right siting, i.e. where these facilities are to be located, but these locations must be feasible and practical.
    - e.g: Locations for wind are required to have adequate wind resources (6m/s at 70 meters) and biomass CHP locations are required to have a sufficient thermal load
  - If providing as-of-right siting for generation, the community must select technology that is practically available and provides a realistic opportunity for generation. It is expected that a community will appropriately utilize its available renewable resources, and this will be taken into consideration in the review of an application meeting this requirement. For example, it would be expected that a community with wind resources of 6m/s or above will provide as-of-right siting for wind generation.
  - As-of-right zoning by-laws can apply appropriate standards that protect public health and safety and provide for non-discretionary site plan review. Reasonable environmental performance standards per the developed by-law may be incorporated into the Site Plan Review (SPR) process (e.g. height, setback, etc...), but cannot be so stringent as to make the use infeasible. The thrust of this aspect of the policy is that SPR be truly non-

discretionary. In other words, if the standards and zoning requirements are met, the project can be built. This is distinct from the Special Permit (SP), in that the SP may be denied if the Planning Board or other permit granting authority is not satisfied with the project.

- An applicant can meet this requirement with as-of-right siting for renewable or alternative energy generation with *one* of the following project requirements:
  - On-shore Wind – a turbine of a minimum 600 kW in size or above
  - Off-shore Wind – a turbine of a minimum 2.5 MW or above
  - Solar Photovoltaic – a single ground-mounted system of a minimum of 250 kW or above
  - Biomass CHP - a minimum of 5MW in a stand-alone building
  - Ocean, wave or tidal – no minimum threshold

**NOTE:** When grant awards are made to those communities who have qualified as a Green Community, special consideration will be given to those who have met the as-of-right siting requirement through renewable and alternative energy generation.

2. Adopt an expedited application and permitting process under which these energy facilities may be sited within the municipality and which shall not exceed 1 year from the date of initial application to the date of final approval.
  - The expedited application and permitting process applies only to the proposed facilities which are subject to the as-of-right siting provision.
  - An applicant can meet this requirement by applying the expedited permitting process of MGL c 43D to these zoning districts.
  - The one (1) year deadline requirement must include an effective enforcement mechanism, such as constructive approval provision
3. Establish an energy use baseline inventory for municipal buildings, vehicles, street and traffic lighting, and put in place a comprehensive program designed to reduce this baseline by 20 percent within 5 years of initial participation in the program.
  - Energy use baseline is applied in the aggregate across building, street lights and vehicles on an MMBTU (million British Thermal Units) basis
  - AFTER all energy reduction measures have been taken, credit may be given for the addition of renewable energy resources to reach the 20% reduction goal.
  - A community can meet this requirement if it has completed an inventory as described above and has already implemented a program to reduce the baseline within the previous 24 months.
  - For applications consisting of more than one community, all communities must complete the inventory. However, the comprehensive program to reduce the baseline by 20% can be applied across all communities.
  - Acceptable tools for performing the inventory are:
    - EnergyStar Portfolio Manager
    - ICLEI software
    - DOER's Energy Information Reporting System
    - Other tools proposed by the community and deemed acceptable by DOER
4. Purchase only fuel-efficient vehicles for municipal use whenever such vehicles are commercially available and practicable.
  - Heavy-duty vehicles such as fire-trucks, ambulances, and public works trucks are exempt from this criterion.

- Police cruisers are exempt from this criterion. However, municipalities must commit to purchasing fuel efficient cruisers when they become commercially available. Police department administrative vehicles must meet fuel efficient requirements.
- If an applicant does not have a vehicle fleet other than heavy-duty vehicles and/or police cruisers, it must propose alternative means for meeting this requirement, eg. having in place policies and procedures that promote reduced fuel usage for the municipality. For example, carpooling incentives for municipal employees, preferred parking for employees with hybrid vehicles, bike racks at municipal buildings and incentives for employees to bike to work.
- An applicant must provide a vehicle inventory for non-exempt vehicles and a plan for replacing these vehicles with vehicles that meet the fuel efficiency ratings below. These fuel efficiency ratings are set to ensure that at least 5 or more automatic transmission models of mass production are available for sale in Massachusetts (all from affordable brands; no luxury brands). Based on 2009 and 2008 EPA data, vehicles are to have a combined city and highway MPG no less than the following:
  - 2 wheel drive car: 29 MPG
  - 4 wheel drive car: 24 MPG
  - 2 wheel drive small pick-up truck: 20 MPG
  - 4 wheel drive small pick-up truck: 18 MPG
  - 2 wheel drive standard pick-up truck: 17 MPG
  - 4 wheel drive standard pick-up truck: 16 MPG

(NOTE: A spreadsheet of the vehicles that meet this requirement is provided on the DOER website: [DOER Fuel Efficient Vehicles Spreadsheet](#))

5. Require all new residential construction over 3,000 square feet and all new commercial and industrial real estate construction to minimize, to the extent feasible, the life-cycle cost of the facility by utilizing energy efficiency, water conservation and other renewable or alternative energy technologies.
  - Cities and towns can meet this requirement by adopting the new BBRS Stretch Code, the new appendix to the MA State Building Code. Should a community chose to not adopt the stretch code and choose to use another standard, the community must provide evidence that this alternative standard minimizes the life cycle energy costs for all new construction and is enforceable by the community

[BBRS Stretch Code](#)